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The collaboration marketplace has been evolving over the last 10 years, delivering technologies that enable coordination and information sharing, virtual meetings, and recently virtual collocation. The promise of these technologies is to improve our collaborate, coordinate, and share information to facilitate inter- and intra-organizational teams. With these technologies, we have an opportunity to better support the mobilization and leverage personnel assets, wherever they may be.

**State of the practice -- Coordination
information sharing**

Most organizations use asynchronous collaboration tools that enable them to coordinate and share information with each other. Examples include electronic discussion groups, information and group calendaring systems. These tools allow people to work together, whether team members are physically collocated. Tools like e-mail enable team members to exchange

electronic messages with attached files. Discussion groups enable teams to conduct discussions, which are available to the team. Information sharing tools such as Web and Lotus Notes enable teams to publish information and can provide an interface to information in corporate directories and databases. Group calendaring systems enable teams to schedule meetings and the necessary resources for the meeting.

This market segment has been maturing over the last 6-10 years and provides a solid technology base, with scalability to support the enterprise. Most of these tools have security (e.g., authentication, encryption, and firewall support). Tools from different vendors are largely interoperable, with most vendors conforming to common standards or formats. It is quite common to find many of these complementary tools bundled as part of a product suite. Key vendors with offerings in this area include Microsoft, IBM, and Lotus.

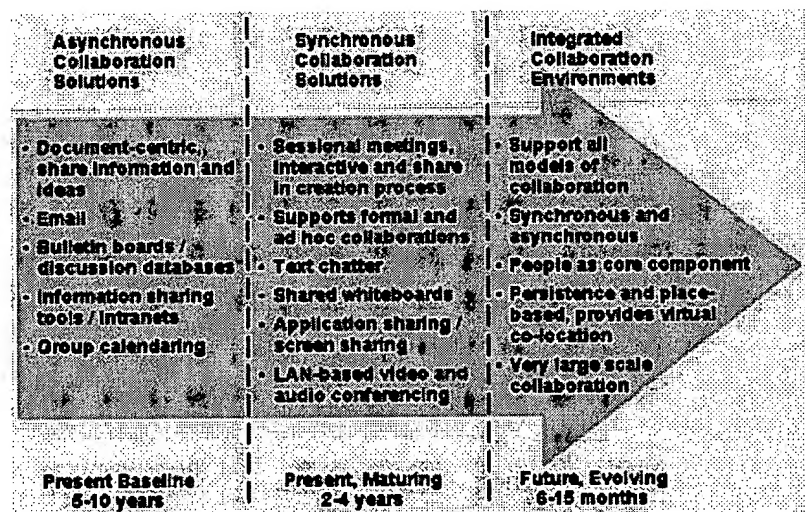
State of the art -- Virtual meetings & interactive production

CVW Evolves as Open Source

The marketplace for real-time conferencing tools has been very active over the last few years. Real-time collaboration tools take us to the next level of collaboration and provide the ability to conduct virtual meetings and share information in real time. Examples include chat, audio/video conferencing, and data conferencing (e.g., shared whiteboards, application sharing).

Text chatter has gained in popularity over the last 1-2 years with the emergence of a chat tool that supports online presence awareness in addition to the chat capabilities. Tools such as AOL Instant Messenger and AOL's Mirabilis ICQ (I Seek You) allow users to create tailored "buddy lists" so they can be made aware when users of interest come online and are available to chat. These tools make it very easy to conduct one-on-one or group conversations. These tools are highly scalable and require very little network bandwidth resources.

Audio and video conferencing tools have started to become more viable over the last few years, but still suffer from issues of stability and scalability to support large conferences. They require sufficient network bandwidth and quality of service to be effective on any network. Although users can effectively use audio on low bandwidth connections such as dial-up, Multipoint conference servers, such as those provided by DataBeam, White Pine, and PictureTel, are required to enable multiple users to participate in an audio/video conference. There are many audio and video conferencing tools, which are interoperable through support for the International Telecommunications Union ITU H.323 conferencing standard. However, there are still proprietary vendor solutions in the marketplace that are not interoperable with other tools.



The use of data conferencing tools, especially application sharing, has become more prevalent in the marketplace with the free availability of Microsoft NetMeeting and similar free tools on Sun and SGI platforms. Most vendors are adopting a common implementation for application sharing into their products (e.g., PictureTel, Intel, Microsoft, and Sun) to support the ITU T.128 standard. Shared whiteboard capabilities have remained constant for a few years, and only custom solutions provide the additional capability required by the Department of Defense (DoD), such as support for geo-registration and specialized data formats (e.g., National Imagery Transmission Format). Many shared whiteboards are not interoperable with each other, and there has been a noticeable lag in adoption of these standards by the vendors. Both application sharing and shared whiteboard data conferencing tools are limited in scalability, and suitable only for smaller work teams. The ITU

family of data conferencing standards, although followed in part by some vendor been adopted as a whole by the vendor community. There has been recent activity weight approaches to data conferencing that are more Web friendly that will challenge T.120 standards. (See [ITU article](#) and [IETF article](#).)

Security has not been adequately addressed by the real-time conferencing tools. If chat tools support some form of authentication, they typically do not support encrypting chat conference data, and some tools introduce firewall risks. Audio/video and data conferencing tools can introduce serious firewall risks, typically have no support for authentication, and we are only beginning to see encryption support for some data conferencing tools, as Christine Eliopoulos [chronicles](#).



The MITRE Collaboration Team discussing the ubiquity of collaboration, extending from the desktop to the palmtop.

Very leading edge -- Virtual collocation

The next wave of collaboration technologies emerging in the marketplace are environments that support virtual collocation, often referred to as "place-based" collaboration environments. These environments integrate people, communications, and shared data, into a shared virtual space. The environment itself is persistent, which means that the shared space, shared data, and properties of the collaboration environment do not go away (such as in a virtual meeting room). Key properties of place-based collaboration environments include rich communications (e.g., text chat and audio conferencing), a shared document store to make documents and other data available, the ability to create tailorable virtual spaces to provide the location and context for the collaboration, management for managing chat, audio/video, and other conferences within the collaborative environment, and presence awareness so that users are aware of others that are available in the collaborative environment.

Place-based collaboration is still an active research area, with two commercial products available in the last two years, TeamWave Workplace and General Dynamics (formerly InfoWorkspace). Place-based collaboration environments are not yet interoperable with each other, and there are currently no standards for virtual space environments. Although these environments support authentication, and privacy of the virtual spaces via access control, additional security is beginning to be addressed by the vendors, with a lack of security

communications and firewall risks.

From bundled toolsets toward system frameworks

Collaboration offerings have developed in the marketplace as individual applications bundled toolsets that offer a tight package of complementary functionality. As collaboration grows from workgroup to enterprise and cross-organizational scale commercial offerings to evolve toward a system framework approach, where collaboration services become integrated with the information infrastructure. The services-based approach, as the longer term architectural approach, will give us flexibility in product choice to meet user requirements, competitive advantage to benefit from rapid technology evolution, innovation, and interoperability from leveraging existing enterprise services (e.g. security, document, search, workflow, and network services). Implementing such a framework is challenging and requires time, as the components for the framework become available and the techniques for integrating the services become better understood.

In the near term, the bundled toolsets will continue to be viable, providing an "out-of-the-box" capability that can be easier to deploy and administer, but with less flexibility with respect to interoperability and tool integration. The critical factor will be for planning for the transition from the tightly integrated toolsets toward the system frameworks, with understanding of the cycle costs and impact of migration on users.

Why aren't we there yet? -- Implementation challenges

As the market continues to rapidly deliver collaboration offerings, organizations are adopting many of these collaboration services into the enterprise. The state of the practice in organizations is with the use of asynchronous collaboration technologies (e.g., e-discussion groups, Web/document servers, group calendaring). Adoption of real-time conferencing is occurring at a slower rate than initially anticipated, but is expected to increase in the next few years, with a focus on data conferencing. The Gartner Group anticipates that synchronous collaboration technologies will be in use by over 10 million users by 2004. The government is ahead of commercial industry with respect to understanding requirements for virtual collocation, and the demand from commercial industry is expected to follow.

But even in the government, there continues to be more of a focus on pilot programs and limited operational deployments rather than enterprise deployment of advanced collaboration services. Reasons for the slower adoption can be attributed to technical/infrastructure and cultural issues.

In order for an organization to be able to successfully use collaboration technologies at enterprise scale, the network and systems infrastructure must be able to support the requirements of the collaboration tools. Real-time conferencing requires available bandwidth and quality of service from the network. Some tools require support for IP multicasting. Organizations must prepare a strategy for managing large-scale rollouts, network administration, training, and support.

To enable cross-organizational collaboration, security policies and security solutions must be in place. Security is often weakly addressed by collaboration tools, requiring organizations to consider additional technologies (such as virtual private networks) and flexibility in policy and an agreed upon concept of operations to enable collaboration across organizations.

This poses a great challenge to adoption of collaboration, beyond challenges we : technology, since there are no policies in place for supporting virtual organization

The most difficult challenge is that of dealing with organizational culture and org readiness to change to support collaborative operations. Even if the systems, network security policies are in place, and the collaboration technology is the most capable it will not have an impact if the members of the organizations do not see a need or a willingness to share information and collaborate. Organizations must work with collaborative culture in the organization and help members to understand the benefits, rewards, how they are expected to work, and how they will be supported. Organizations to work with staff to understand how to use collaboration technology to improve process and realize improvement. Members of the organization should be involved beginning in helping to define the concept of operations, understanding the rollout process, and evolving organizational goals.

All of these challenges in implementing collaboration take time, careful planning with an associated cost. Piloting and early experimentation, with a plan to build on what is learned and expand to more members of the organization, can help to ease the rollout. Organizations should expect failures, but examine them closely to understand the lessons that the next iteration can become more successful.

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